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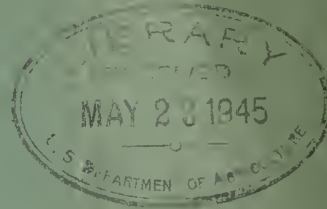
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BIBLIOGRAPHY OF CHLOROPICRIN, 1932-1934
(First Supplement to U. S. Dept. Agr. Misc. Pub. 176)

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BIBLIOGRAPHY OF CHLOROPICRIN, 1932-1934

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This publication is intended as a first supplement to United States Department of Agriculture Miscellaneous Publication No. 176 entitled "Bibliography of Chloropicrin, 1848-1932," which was issued in February, 1934.

Chloropicrin, although not as important an insecticidal fumigant as hydrogen cyanide, carbon disulphide, and ethylene oxide, nevertheless continues to attract the attention of entomologists and others interested in pest control by chemical means. Chloropicrin also retains its interest to army men as a potent war gas. During the past two years numerous articles dealing with this compound have been published, and it seems desirable to keep abreast of this progress by the publication, from time to time, of brief abstracts of this information.

This supplement does not contain a complete list for 1932; it includes papers published in 1932 that were not available to the compilers when the earlier list was being prepared. The list for 1934 is incomplete; it covers those papers that were abstracted in leading abstract journals during 1934. References are included to publications that appeared prior to 1932 but were overlooked in compiling Miscellaneous Publication No. 176.

BIBLIOGRAPHY

ANONYMOUS

(1)

COMMISSION D'ÉTUDES DES ENNEMIS DES ARBRES, DES BOIS ABÉATUS ET DES BOIS MIS EN ŒUVRE. Bul. 7, 8 p., illus. Bul. 8, 13 p., illus. 1931-1932. [Abstract in Rev. Appl. Ent. 21 (A): 670. 1933.]

Furniture infested with the cerambycids Hylotrupes bajulus L. and Criocephalus rusticus L. can be fumigated with chloropicrin.

(2)

PROPERTIES OF WAR GASES OF THE WORLD WAR AND POST-WAR PERIODS.

Gasschutz u. Luftschutz 2: 264. 1932. [In German. Abstract in Chem. Abs. 27: 353. 1933.]

The properties of a large number of war gases, including chloropicrin, are given in tabular form. Melting point, boiling point, specific gravity, weight of one liter of vapor at 20°, concentration in saturated air, and highest concentration endurable for one minute are given.

ALEKSEEVSKII, E. V.

(3)

A QUALITATIVE REACTION FOR CHLOROPICRIN. Jour. Chem. Indus.

[U.S.S.R.] 8: 50-51. 1931. [In Russian. Abstract in Chem. Abs. 26: 2672. 1932.]

An aqueous solution of chloropicrin reduced with metallic calcium gives some nitrous acid, shown by the red precipitate with beta-naphthylamine and sulphuric acid. The reaction is sensitive to 0.002 mg. per liter. It is not suitable for a quantitative determination.

(4)

PHOTOLYSIS OF CHLOROPICRIN IN AQUEOUS SOLUTION. Jour. Gen. Chem.

[U.S.S.R.] 2: 341-344. 1932. [In Russian. Abstract in Chem. Abs. 27: 231. 1933.]

The acceleration of decomposition of chloropicrin in water on exposure to actinic rays is increased in the following order of the source of illumination: Röntgen, voltaic arc, mercury quartz lamp. Analogous action is effected with activated carbon, best results being obtained with carbon treated with one percent sodium hydroxide and dried. The reaction is thus formulated: $\text{CCl}_3\text{NO}_2 = \text{COCl}_2 + \text{NOCl}$; $\text{COCl}_2 + 2\text{H}_2\text{O} = \text{H}_2\text{CO}_3 + 2\text{HCl}$; $\text{NOCl} + \text{H}_2\text{O} = \text{HCl} + \text{HNO}_2$.

and PIKAZIN, Y. S.

(5)

INFLUENCE OF SOME CHEMICAL AND PHYSICAL FACTORS ON THE ACTIVITY OF CHARCOAL. III. INFLUENCE OF ALKALI IMPREGNATION. Jour.

Gen. Chem. [U.S.S.R.] 2: 327-334. 1932. [In Russian. Abstract in Chem. Abs. 27: 1797. 1933.]

With chloropicrin there was an increase of adsorption with samples treated with 0.1 N sodium hydroxide and 0.1 N potassium hydroxide, but not with the sample treated with 1.0 N sodium hydroxide.

ARAKAWA, Y.

(6)

THE RESISTANCE OF THE CLOTHES LOUSE TO VARIOUS INSECTICIDES.

Oyo-Dobuts. Zasshi 4: 86-92. 1932. [In Japanese. Abstract in Rev. Appl. Ent. 20 (B): 207. 1932.]

Fumigation with chloropicrin is an effective control measure for Pediculus humanus L.

ASSMANN, H. (7)
ÜBER DIE EINWIRKUNG DER KAMPF- UND BOMBENGASE AUF DEN MENSCHLICHEN KÖRPER. Deut. Med. Wchnschr. 58: 1630-1632. 1932.

The action on the human body of the "green cross" gases, composed partly of gaseous and partly of finely divided liquid material, of which chloropicrin is one, is described.

BARNES, D. F., and FISHER, C. K. (8)
STIMULATION OF FIG INSECTS BY CERTAIN FUMIGANTS. Jour. Econ. Ent. 27: 860. 1934.

The average percentages of insects caused to leave figs and killed by fumigation with chloropicrin were 67.8 percent of larvae (98.5 percent Carpophilus hemipterus L.), 72.3 percent of beetles (chiefly C. hemipterus), and 2.6 percent of the larvae of Ephestia figulilella Greg.).

BECK (9)
CHEMISCHE KAMPFSTOFFE WAHREND DES KRIEGS UND IHRE WEITERENTWICKLUNG. Süddeut. Apoth.-Ztg. 73: 581-588. 1933.

The effects of chlorine, phosgene, and chloropicrin are briefly described. A large number of chemical war gases are discussed briefly.

BEHRECKE, H. (10)
WARNING AGENT FOR POISON GASES. U. S. Patent 1,786,623, issued December 12, 1930; applied for June 24, 1926.

Five to ten percent of chloropicrin is added to hydrocyanic acid. The mixture of gases may be adsorbed on animal charcoal, kieselguhr, or the like for use.

BOLDYREW, T. E. (11)
ANWENDUNGSVERSUCH VON CHLORPIKRIN BEI DER DISINFEKTION DER KASERNENRAUME. Mil. Med. Jour. [U.S.S.R.] 2:211-214. 1931. [In Russian. Abstract in Chem. Zentbl. 103, II: 1223-1224. 1932.]

Ten cc. of chloropicrin per cubic meter suffices to kill all insects and eggs in 48 hours in barrack rooms.

BOUVIER (12)
RECHERCHES SUR L'ACTION DE LA CHLOROPICRINE SUR LE VER ROSE DU COTONNIER, LA GRAINE DE COTON, LE CHARANCON DU BLÉ ET LA GRAINE DE BLÉ. Acad. Agr. France Compt. Rend. 19: 76-79. 1933.

An address describing work done by C. R. Shabetai. Eight to ten mg. of chloropicrin per liter suffices to destroy Gelechia gossypiella Saund. in cotton seed in 20 hours. This concentration does not affect the germination of the seed. Similar results were obtained with weevils in wheat. Much greater doses of chloropicrin destroy the germinating power of the seeds.

BURROWS, R. B., and HUNTER, L. (13)
THE NITRATION OF HALOGENETHYLENES. Jour. Chem. Soc. [London] 1932:
1357-1360.

A small amount of chloropicrin was obtained by the action of a mixture (150 cc.) of equal volumes of fuming and concentrated nitric acids on dichloroethylene (40cc.)

CARPENTER, C. W. (14)
PREDISPOSING FACTORS IN PYTHIUM ROOT ROT [OF SUGAR CANE]. Hawaii.
Planters' Rec. 38: 279-338. 1934.

In the phosphate-fixing soils studied, there was sufficient available phosphate present to permit normal growth of Sudan grass and young cane plants when Pythium was eliminated by chloropicrin fumigation.

CONNOLLY, J. M., and DYSON, G. M. (15)
CONSTITUTION AND REACTIONS OF THIOCARBONYL TETRACHLORIDE. PART I.
REACTION WITH ARYLAMINES. Jour. Chem. Soc. [London] 1934: 822-824.
Treatment with fuming nitric acid of 2,2,5,5-tetrachloro-1,4-di-
p-tolyl-1,2,4,5-tetrahydro-3,6-dithiapyrazine,
 $\text{MeC}_6\text{H}_4\text{H} \cdot \text{CH}_2\text{CCl}_2\text{S} \cdot \text{N}(\text{C}_6\text{H}_4\text{Me}) \cdot \text{CCl}_2\text{S}$, gives chloropicrin.

COOKE, D. A. (16)
RELATION OF PYTHIUM TO GROWTH FAILURE ON PHOSPHATE FIXING SOILS. Assoc.
Hawaii. Sugar Tech. Rpts., 12th Ann. Meeting, 1933: 169-178.

In Mitscherlich pot tests certain Hawaiian soils fixed all the phosphoric anhydride added, and 3 to 7 times the normal dose had to be given for maximum growth. Small quantities of chloropicrin gave the same results as high phosphoric anhydride. The chloropicrin brought about no chemical or physical change in the soil, and it did not stimulate plant growth directly. Nematodes and protozoa were not affected by it. It was finally found that the chloropicrin destroys the cane root rot fungus Pythium aphanodermatum. The similar effect of phosphate is explained by the stimulation and strengthening of root growth. The use of chloropicrin would be too expensive in practice.

COTTON, R. T. (17)
THE RELATION OF RESPIRATORY METABOLISM OF INSECTS TO THEIR SUSCEPTIBILITY TO FUMIGANTS. Jour. Econ. Ent. 25: 1088-1103. 1932.

The kill of adults of Tribolium confusum Duv. in 30 minutes at 86° F. when exposed to 16.5 mg. of chloropicrin per liter with added carbon dioxide, varied from 10 percent with no added carbon dioxide to 96 percent with 40 lbs. of carbon dioxide per 1000 cu. ft. In an atmosphere containing 37 pounds of carbon dioxide per 1000 cu. ft. a dosage of 16.5 mg. of chloropicrin per liter gave a 97-percent kill, while without the carbon dioxide a dosage of 41.25 mg. of chloropicrin per liter was required to give a similar kill.

DANĂILĂ, N., and SOARE, A. G. (18)
THE PREPARATION OF CHLOROPICRIN FROM THE GAS METHANE. Bul. Chim. Soc.
Române Chim. 35: 53-75. 1932. [In Roumanian. Abstract in Chem.
Abs. 28: 3712. 1934.]

The authors, seeking a cheap method of preparing chloropicrin, have investigated every possible method and report all their results, both positive and negative. They have found that the only possible procedure

is to chlorinate the methane to chloroform and then to nitrate this. When one volume of methane and three of chlorine were passed at the rate of 0.24 liter per minute over pumice containing 2 percent cupric chloride heated to 360 to 370° in a 60-cm. silica tube 3 cm. in diameter, 41.05 percent of the chlorine formed liquid products, 5.76 percent formed gaseous products, and 52.17 percent formed hydrogen chloride. The composition of the liquid was 63 percent chloroform, 30 percent carbon tetrachloride, and 7 percent higher homologues. Carbon tetrachloride was reduced to chloroform electrolytically, and with both alkaline and acid reducing agents (zinc or ferrous sulphate plus sodium hydroxide, and zinc plus hydrochloric acid). All the methods gave fair results, but there was much loss because of over-reduction. The best yield was 8.5 grams of chloroform from 20 grams of carbon tetrachloride with zinc plus hydrochloric acid. A 58-percent yield of chloropicrin was obtained when equal volumes of chloroform and nitric acid (d. 1.52) were heated to 140 to 150° under pressure for two hours. The authors conclude that the method is technically and economically advantageous.

DAUTREBANDE, L.

(19)

LES GAZ TOXIQUES. 371 p., illus. Paris. 1932.

Chloropicrin is a chemically stable substance, very readily obtained by the action of chloride of lime on picric acid or of sodium hypochlorite on sodium picrate. It has a caustic action on the lungs and provokes pulmonary edema. It is also a lachrymator. It is rarely employed alone and is generally, on the battlefield, mixed with phosgene or diphosgene (p. 183).

DEEV, D. I.

(20)

APPARATUS FOR DISINFECTION. Profilak. Med. 11: 85-86. 1932. [Reference in Quart. Cumulative Index Medicus 13: 307. 1933]

DOBROVOLNY, F. J.

(21)

METHYL CHLORIDE REFRIGERANT. U. S. Patent 1,879,893, issued September 27, 1933; applied for February 10, 1930.

About 1 to 6 percent of chloropicrin is used with methyl chloride as a leakage-warning agent.

DRAGERWERK

(22)

DRAEGER-GASSCHUTZ IM LUFTSCHUTZ. 288 p., illus. Lübeck. 1933.

Chloropicrin persists longer in contaminated areas than phosgene because of its lesser volatility (p. 83).

DUBININ, M. M.

(23)

ÜBER DIE BERECHNUNG DER ARBEIT DER ADSORBENSSCHICHT. Chem. Jour.

Series B. Jour. Angew. Chem. [U.S.S.R.] 4: 283-292. 1931.

[In Russian. Abstract in Chem. Zentbl. 103 (I): 1505. 1932.]

Mathematical derivation of a formula for the calculation of the work of an adsorbing layer. For a layer of carbon (diameter of grains = 1.5 mm.) of 5 cm. in length and 100 sq. cm. in cross-sectional area, a resistance-time of 338 minutes results for the passing through of a chloropicrin-air mixture (chloropicrin concentration = 4×10^{-2} millimol per liter) with a velocity of 30 liters per minute.

EICHHOLTZ, F.

(24)

TOXIKOLOGIE DER KRIEGSGASE. Deut. Med. Wchnschr. 58: 1629-1630. 1932.

Chloropicrin is mentioned as belonging to the "green cross" group of lung irritant gases.

ELBS, K.

(25)

EINIGE SYNTHESSEN MIT CHLORPIKRIN MITTELST CHLORALUMINIUM. Ber. Deut. Chem. Gesell. 16: 1274-1277. 1883.

Chloropicrin and benzene with aluminum chloride yield triphenyl carbinol, triphenylmethane, and a very little diphenylmethane. Chloropicrin and phenol in the presence of aluminum chloride form aurin ($C_6H_4OH)_2C_6H_4CO$ and a small amount of aluminum oxide. Chloropicrin and naphthalene in the presence of aluminum chloride produce trinaphthylcarbinol. Chloropicrin and phenanthrene react similarly to naphthalene.

ELBS, K., and WITTICH, O.

(26)

UEBER DIE EINWIRKUNG DES CHLORPIKRINS UND CHLOROFORMS AUF TOLUOL BEI GEGENWART VON ALUMINIUM CHLORID. Ber. Deut. Chem. Gesell. 18: 347-349. 1885.

By the reaction between chloropicrin, chloroform and toluene in carbon disulphide in the presence of aluminum chloride, the authors obtained dimethylantracene and a little ditolylmethane and tritolylmethane.

FEYTAUD, J.

(27)

RECHERCHES SUR LE DORYPHORE (LEPTINOTARSA DECEMLINEATA, SAY). Ann. Epiphyt. 18: 97-220. 1932. [Abstract in Rev. Appl. Ent. 21 (A): 6. 1933.]

Excellent results were obtained with chloropicrin as a disinfectant for soil infested with pupae of the Colorado potato beetle, Leptinotarsa decemlineata Say.

GEMEINHARDT, K.

(28)

DIE ENTWICKLUNG DER CHEMISCHEN WAFFE. Gasschutz u. Luftschutz 1931: 53-56. [Abstract in Chem. Zentbl. 103 (I): 168. 1932.]

Chloropicrin is listed among the seven most effective of the gases employed in the World War.

GODFREY, G. H.

(29)

CHLORPICRIN INJURIOUS TO GREENHOUSE PLANTS. Science 77: 583. 1933.

In an experimental fumigation of a plant bed, for nematode control, just outside a greenhouse, some of the gas escaping from the soil found its way into the house and caused severe injury to tobacco, strawberry, coleus, and other plants. The actual concentration of the gas as it became diffused into the greenhouse atmosphere was very low, probably not greater than 20 parts per million.

(30)

CONTROL OF SOIL FUNGI BY FUMIGATION WITH CHLOROPICRIN. Phytopath. 24: 1146-1147. 1934.

In laboratory tests, chloropicrin, used at the rate of 400 lbs. per acre-foot, completely inhibited the growth of various plant-parasitic soil fungi, including Fusarium sp. from gladiolus, Verticillium alboatrum from strawberry, Phytophthora cactorum from snapdragon, Rhizoctonia solani and Sclerotium rolfsii from sugar beet, and the root-rotting fungi Armillaria mellea and Dematophora sp.

GODFREY, G. H.

(31)

THE CONFINEMENT OF CHLOROPICRIN AND OTHER GASES FOR FUMIGATION PURPOSES.

Phytopath. 24: 1366-1373. 1934.

Papers coated with thin continuous films of adhesive, hydrophyllic colloids, particularly glues of various kinds, gelatine, and starch paste, were highly efficient in confining chloropicrin. Cellulose acetate was also good.

OLIVIERA, J., and HOSHINO, H. M.

(32)

INCREASED EFFICIENCY OF CHLOROPICRIN FOR NEMATODE CONTROL WITH BETTER CONFINEMENT OF THE GAS. Phytopath. 24: 1332-1346. 1934.

In greenhouse tests, adequate confinement of chloropicrin in the soil with a cover highly impervious to gas was found to be indispensable to best results in the control of nematodes (Heterodera marioni). Ordinary Kraft paper, coated with a thin sizing of animal-product glue or casein glue, when placed over the soil and sealed at the edges, proved to be highly efficient for the purpose. Chloropicrin, applied at rates of 300 and 350 pounds per acre in closed containers with covers as described, gave better than 99 percent control. The same technique applied to small field plots, with the covers sealed to metal or wood frames about the plots, did not show quite so high percentage control of nematodes, but did result in remarkably increased vigor of tomato plant growth.

Conditions essential to high efficiency of chloropicrin treatment for nematode control are: (1) Complete decay, before treatment, of any residue in the soil of infested roots of a previous crop; (2) good loose tilth and absence of excessive moisture; (3) rates of application of from 250 to 400 pounds per acre; (4) points of application not more than 18 inches apart; (5) efficient confinement of the gas in the soil by means of a cover of gas-impervious material, such as glue-coated paper, with the edges sealed to a frame or sunk well beneath the surface of the soil.

GRAHAM, R., and MICHAEL, V. M.

(33)

STUDIES ON INCUBATOR HYGIENE. III. GERMICIDAL PROPERTIES OF FORMALDEHYDE, SULFUR DIOXIDE, CHLOROPICRIN AND CHLOROACETOPHENONE. Poultry Sci.

13: 40-43. 1934.

Chloropicrin (10 cc. in 9 cc. of parafin oil) exhibited no appreciable germicidal effect on S. pullorum when released in a forced draft incubator of approximately 550 cu. ft. capacity. Chloropicrin in the same amount caused the death of 12-week-old chicks in less than 3 hours.

GRÜNBERG, B. M.

(34)

DERMESTIDAE AS PESTS OF SERICULTURE. Reconstr. Seric. [U.S.S.R.] 3-4: 127-147. 1931. [In Russian with summary in French. Abstract in Rev. Appl. Ent. 21: 56-57. 1933.]

Fumigation of silkworm (Bombyx mori L.) cocoons infested with Trogoderma versicolor Creutz. with chloropicrin at the rate of 17 to 20 oz. to 1000 cu. ft. for 24 hours at a temperature of at least 20° C. (68° F.) gave good results.

HAMPE, E.

(35)

DER MENSCH UND DIE GASE. 112 p., illus. Berlin. 1932.

Chloropicrin is listed with the lung-poisoning (green cross) war gases. It is distinguished from the others of this group (phosgene and "perstoff" or diphosgene) by the fact that it makes its presence known by irritation, especially of the eyes. It is usually used as an addition to other war materials to reduce the volatility. It is also very stable toward water. Protection is furnished by an air filter (p. 38). The properties of various war gases are given in tabular form. Chloropicrin can be destroyed with alkali solutions or a solution of liver of sulphur (p. 106, 108).

HEIM, W.

(36)

GIFTIGE GASE UND GASSCHUTZ. Deut. Apoth. 2: 646-651. 1934.

Chloropicrin, called "Klop" by the Germans, is mentioned as a war gas, and its physical properties and physiological action are briefly stated. The breathing of 16 mg. per minute is fatal. Nineteen mg. per cu. m. of air produces an irritant action on the eyes. Gas masks give full protection.

HILLMAN, C. C.

(37)

CARE OF GAS CASUALTIES. Mil. Surg. 70: 529-549. 1932.

Directions are given for the treatment of soldiers who have been gassed with chloropicrin. Chloropicrin is classed as a lung irritant (p. 534-537).

IRVINE, J. C.

(38)

ORGANIC CHEMISTRY. Part I. ALIPHATIC DIVISION. Chem. Soc. (London) Ann. Rpt. 16: 55-87. 1919.

Chloropicrin, large quantities of which had accumulated at the close of the war, can be economically employed for the production of methylamine. The chloropicrin is reduced with iron and hydrochloric acid.

IZARD, L., CILLEULS, J. des, and KERMARREC, R.

(39)

LA GUERRE AÉRO-CHIMIQUE ET LES POPULATIONS CIVILES. 2d ed. 212 p., illus. Paris. 1932.

Chloropicrin is classified as a suffocating, lachrymatory and toxic gas (p. 44, 45, 48). Eight-tenths mg. per liter of air is fatal when breathed by man. It produces great nausea (p. 48). The physiological effects are quite fully described (p. 66, 75-86). Treatment for victims of the suffocating gases is prescribed. The importance of absolute rest is stressed. [An extract from this book is given in Rev. Hyg. et Med. Prev. 54: 569-594, 1932, and abstracted in Chem. Abs. 27: 1403, 1932.]

JACKSON, K. E.

(40)

CHLOROPICRIN. Chem. Rev. 14: 251-286. 1934.

The preparation, physical properties and chemical properties of chloropicrin are discussed in considerable detail. Detection and physiological action are briefly described. The uses of chloropicrin are discussed and a rather lengthy list of organisms is given against which favorable experimental results have been obtained. Quite a comprehensive bibliography is included.

- JENSEN-STORCH, S. V., and HENRICKSEN, K. L. (Eds.) (41)
FIRST REPORT ON INVESTIGATIONS ON MEANS AGAINST HYLOTRUPES BAJULUS.
Meddel. Udvalget til Undersøgelse af Midler mod Træspidelaeggende
Organismer. 162 p., illus. Copenhagen. 1932. [In Danish. Ab-
stract in Rev. Appl. Ent. 20 (A): 456. 1932].

Chloropicrin showed poor expansive and penetrative power when
tested against Hylotrupes bajulus L., a beetle infesting timber in
Denmark.

- JOHNSON, M. O. (42)
METHOD OF FUMIGATING SOILS AND COMPOUND FOR USE THEREIN. U. S. Patent
1,983,546, issued December 11, 1934; applied for October 23, 1929;
assigned to California Packing Corp., San Francisco, Calif.

A method of stimulating the growth of pineapple plants comprises
liberating chloropicrin beneath the surface of the soil and retarding the
upward escape of the vapors from the soil by means of an impervious
covering laid on the surface.

- KAISER, H. (43)
DIE REZEPTUR BEI KAMPEFGASVERGIFTUNGEN. Süddeut. Apoth.-Ztg. 73: 592-594.
1933.

Prescriptions are given for treatment of intoxications produced by
war gases, including chloropicrin.

- KAMITO, A. (44)
ON THE BROAD BEAN WEEVIL INTRODUCED IN JAPAN. Imp. Acad. Tokyo Proc.
9: 137-139. 1933.
For the control of Bruchus rufimanus Boh. fumigation with 1.5 lbs.
chloropicrin or 5 lbs. carbon disulphide per 30 cu. m. (1,059 cu. ft.)
with an exposure of 36 to 48 hours is recommended.

- KORAB, I. I., and BUTOVSKII, A. P. (45)
CHLOROPICRIN AS A NEW REMEDY AGAINST BEET NEMATODES. Nauk. Zapiski
Tzukrovai Prom. 21-22: 149-162. 1932. [In Russian. Reference in
Chem. Abs. 27: 555. 1933.]
No abstract given.

- KRETOV, A. E., and MELNIKOV, N. M. (46)
OXIDIZING PROPERTIES OF HALONITROMETHANES. Jour. Gen. Chem. [U.S.S.R.]
2: 202-207. 1932. [In Russian. Abstract in Chem. Abs. 27: 952.
1933.]

Equations are given showing the reaction of chloropicrin with
(1) mercaptans; (2) potassium iodide in alcohol; (3) potassium and sodium
sulphides; and (4) potassium bisulphide.

- LANDAUER, E. (47)
USE OF TEAR GAS IN FUMIGATION WITH HYDROGEN CYANIDE. Chinese Med. Jour.
47: 896-906. 1933. [Abstract in Chem. Abs. 28: 5589. 1934.]

The efficiency of cyanogen chloride, benzyl bromide and chloropicrin
as indicators for the presence of hydrogen cyanide when used as a fumigant
increases in the order given.

LEHALLEUR, J. P.

(48)

DESTRUIÇÃO DOS PARASITAS EM AGRICULTURA COM O AUXÍLIO DA CHLOROPICRINA.
A Lavoura 29: 133-135. 1925.

In São Paulo, harvested coffee is fumigated with chloropicrin to destroy Stephanoderes coffea. The sacks of coffee are stacked in the field and covered with canvas which has been treated with linseed oil. Chloropicrin at the rate of 10 gm. per quintal of coffee berries is introduced under the canvas and allowed to act for 15 days. The author believes that the commercial production of chloropicrin might advantageously be developed in Brazil.

LINDGREN, D. L., and SHEPARD, H. H.

(49)

THE INFLUENCE OF HUMIDITY ON THE EFFECTIVENESS OF CERTAIN FUMIGANTS
AGAINST THE EGGS AND ADULTS OF TRIBOLIUM CONFUSUM DUV. Jour. Econ.
Ent. 25: 248-253. 1932.

The five-hour median lethal concentration of chloropicrin to the eggs of Tribolium confusum Duv. at 25° C. was 45 mg. per liter at low humidity and 16 mg. per liter at high humidity. For the adults it was 4.4 mg. per liter regardless of the humidity.

LOKHOV, M. G., and SAMSONOV, F. B.

(50)

THE APPLICATION OF CHLOROPICRIN IN COMBATING INFESTATION BY LICE
UNDER VILLAGE CONDITIONS. Rev. Microbiol. [U.S.S.R.] 11: 289-294.
1932. [In Russian with summary in German. Abstract in Rev. Appl.
Ent. 21 (B): 161. 1933. Reference in Quart. Cumulative Index
Medicus 16: 508. 1934.]

A brief account is given of the successful use of chloropicrin for fumigating dwellings and clothing during a typhus epidemic. The use of fumigating chambers and of chests or of pits dug in the soil is described.

MARTIN, J. P.

(51)

[REPORT ON] PATHOLOGY. Hawaii. Sugar Planters' Assoc. Proc. 53d Ann.
Meeting (Rpt. Committee in Charge Expt. Sta.) 1933: 24-35.

Depressed growth of Sudan grass and sugar cane, similar to that in phosphate-fixing soil, was produced by inoculating chloropicrin-treated soil with the fungus Pythium sp.; soils similarly treated, inoculated, and fertilized heavily with phosphates produced normal plants. In pot and field tests chloropicrin-treated soil consistently gave a growth response somewhat similar to heavy fertilization but comparable to heavy applications of phosphates in certain Hamakua soils; as a rule this growth response was only temporary and seemed to be due to the effect of the chloropicrin in killing Pythium sp. and other parasites.

MARUMO, N.

(52)

ON A METHOD OF CONTROLLING WHITE GRUBS IN LAWNS. Oyo-Dobuts.-Zasshi
2: 140. 1930. [In Japanese. Abstract in Rev. Appl. Ent. 18 (A):
614. 1930.]

An emulsion of 250 cc. chloropicrin, 160 cc. water and 7.5 gm. soap, used at the rate of 150 cc. in 120 liters of water over an area of 10 sq. m., killed lamellicorn larvae in lawns but injured the grass.

MESNIL, L.

(53)

LA CHLOROPICRINE ET SON EMPLOI POUR LA DISINFECTION DES MATIÈRES
ENTREPOSÉES. Bull. Mens. Soc. Natl. Hort. France 6: 234-237. 1933.

Chloropicrin is a substance in incontestable insecticidal value but possesses a certain action on the substrate, dependent on the temperature, the humidity of the substances treated and the duration of the treatment. The germinating power of grains for planting may be diminished. In the case of food substances, more precise figures on its persistence would be useful. Finally, chloropicrin has the serious inconvenience of being toxic to man and difficult to manipulate, requiring special personnel and apparatus. The disinfection of stored products with dry heat or by the use of less dangerous insecticidal substances is more advisable.

MEYER, W.

(54)

DIE AEROCHEMISCHEN KAMPFSTOFFE UND IHRE ABWEHR. Pharm. Ztg. 78:1280-1282. 1933.

Under the green cross group of chemicals the physical properties and physiological effects of chloropicrin are described. In contradistinction to phosgene and diphosgene, it is not destroyed by water or dilute acids. Gas masks give full protection. Treatment for persons exposed to these gases is prescribed.

MILONE, M.

(55)

SULL'EFFETTO RAMAN DEL TETRANITROMETANO. Gaz. Chim. Ital. 63: 453-456. 1933.

Contrary to evidence obtained by chemical and physico-chemical means by various authors, a study of the Raman effect indicates that the formula of chloropicrin is $\text{CCl}_3(\text{NO}_2)$, i. e., a true nitro derivative.

MICHELbacher, A. E.

(56)

CHEMICAL CONTROL OF THE GARDEN CENTIPEDE, SCUTIGERELLA IMMACULATA. Calif. Agr. Expt. Sta. Bul. 548. 19 p., illus. 1932.

Chloropicrin at the rate of 280 pounds per acre did not give adequate control of garden centipedes (Scutigereella immaculata Newp.) in soil.

MITSUORI, S.

(57)

A STUDY ON THE DESTRUCTION OF A HOUSE-INFESTING TICK (LIPONYSSUS NAGAYOI). Jour. Pub. Health Assoc. Japan 8: 1-4. 1932. [Abstract in Trop. Dis. Bul. [London] 30: 316. 1933. Also in Rev. Appl. Ent. 21 (B): 215. 1933.]

In experiments on the control of the mite Liponyssus nagayoi Yamada, which attacks man, the most effective results were obtained with volatile chemicals such as chloropicrin.

MIX, K.

(58)

VERHUTUNG UND BEKÄMPFUNG VON KOHLENOXYDGAS-VERGIFTUNGEN. Gesundh.-Ing. 56: 292-294. 1933.

The filter of the Degea apparatus for protection against carbon monoxide will absorb 21.8 gm. of chloropicrin.

MORJEW, W. A.

(59)

EIN VERSUCH DES GEBRAUCHS VON CHLORPIKRIN AUF EINIGEN SCHIFFEN DER BALTISCHEN FLOTTE ALS DESINFektionsMITTEL. Mil. Med. Jour. [U.S.S.R.] 2: 383-388. 1931. [In Russian. Abstract in Chem. Zentbl. 103 (II): 2485. 1932.]

Chloropicrin is a good disinfecting agent for insects and their

eggs but has no bactericidal action. The dose is 10 to 15 cc. per cubic meter for 24 hours.

MORJEW, W. A.

(60)

ANTWORT AUF DIE ARBEIT VON T. E. BOLDYREW: "UBER DIE MÖGLICHKEIT DER ANWENDUNG VON CHLORPIKRIN ZUR DESINFEKTION DER KLEIDUNG." Mil. Med. Jour. [U.S.S.R.] 2: 550. 1931. [In Russian. Abstract in Chem. Zentbl. 103, II: 2485. 1932.]

By the method of Boldyrew a full disinfection of clothes with chloropicrin is scarcely obtainable. Evaporation of chloropicrin in portions on a hot plate is more satisfactory.

MUNTSCH, O.

(61)

LEITFADEN DER PATHOLOGIE UND THERAPIE DER KAMPFSTOFFERKRANKUNGEN.

94 p., illus. Leipzig. 1932.

A quite long and detailed discussion is included of the special pathology and therapy of illness caused by the gases of the green cross group (phosgene and chloropicrin). Photographs and charts are given (p. 24-46).

MYULLER, V. A., and AGLINTSEVA, M. G.

(62)

EFFECT OF CHLOROPICRIN ON SMALLPOX VIRUS AND ITS USE FOR PURPOSES OF DISINFECTION. Vestnik Mikr., Epidemiol. i Parazitol. 12: 125-131. 1933. [Reference in Quart. Cumulative Index Medicus 16: 612. 1934.]

NAKAYAMA, S.

(63)

BIOLOGICAL STUDIES ON THE DERMAESTID BEETLE, TROGODERMA GRANARIUM EVERTS. Jour. Agr. Expt. Sta. Govt.-Gen. Chosen 18: 1-23. 1931. [In Japanese with summary in English. Abstract in Rev. Appl. Ent. 21 (A): 149. 1933.]

Fumigation with 8 to 16 oz. of chloropicrin per 1000 cu. ft. for 48 hours killed all stages of Trogoderma granarium Everts, a pest of stored rice.

(64)

BIOLOGICAL STUDIES ON THE RICE WEEVIL, CALANDRA ORYZAE LINNAEUS.

Jour. Agr. Expt. Sta. Govt.-Gen. Chosen 18: 25-69. 1931. [In Japanese with summary in English. Abstract in Rev. Appl. Ent. 21 (A): 149-150. 1933.]

All stages of the rice weevil Calandra oryzae L. may be controlled by fumigation with chloropicrin at the rate of 1 lb. to 1000 cu. ft. for 72 hours, or longer if the temperature is below 70° F.

NEUSS, O.

(65)

TREATMENT OF GAS CASUALTIES WITH OXYGEN. Gasmaske 6: 44-45. 1934.

[In German. Abstract in Chem. Abs. 28: 3498. 1934.]

In the treatment of lung injuries due to chloropicrin and similar respiratory poisons the use of oxygen is indicated to prevent suffocation. The oxygen should not be administered under pressure for fear of rupturing the lung. An admixture of carbon dioxide to stimulate the respiratory center is not necessary since the organs and the blood are already overloaded with carbon dioxide. An automatic inhalation apparatus of the Degea-andos type is recommended.

ONOE, T., and IWASAKI, S.

(66)

FUMIGATION EXPERIMENTS WITH THE RICE BORER, I. *Oyo-Dobuts. Zasshi* 4: 146-147. 1932. [In Japanese. Abstract in *Rev. Appl. Ent.* 20 (A): 653. 1932.]

In fumigation experiments, hibernating larvae of Chilo simplex Butl. in rice straws were killed by chloropicrin in 24 hours, carbon disulphide and hydrocyanic acid gas being less effective.

PAGNIELLO, A.

(67)

CHIMICA DI GUERRA. POSTO DI SOCCORSO SANITARIO ANTIGAS. *Indus. Chim. [Rome]* 8: 1102-1108. 1933.

Chloropicrin, usually classified as an energetic and efficacious lachrymator, also possesses narcotic properties, and if breathed provokes tracheal hemorrhage, acute pulmonary edema, vomiting, etc. Treatment is prescribed for victims of the various types of war gases.

POLITOV, A. K.

(68)

AN EXPERIMENT IN THE APPLICATION OF CHLOROPICRIN AND CARBON BISULPHIDE IN THE CONTROL OF THE LARVAE AND PUPAE OF MOSQUITOES. *Med. Parasit. and Parasit. Dis. [U.S.S.R.]* 1: 32-37. 1932. [In Russian. Abstracts in *Rev. Appl. Ent.* 21 (B): 257-258, 1933; *Chem. Abs.* 28: 2819, 1934; *Trop. Diseases Bul.* 30: 606-607, 1933; and *Pub. Health Engin. Abs. (U. S.)*, 13 (Ma): 31, Nov. 25, 1933.]

An account is given of experiments in the northern Caucasus on the action of chloropicrin and carbon bisulphide on larvae and pupae of Anopheles and Culex. Chloropicrin does not mix with water but sinks to the bottom. Its solubility in water is 10.65 gm. per liter at 18° C. (64.4° F.). The time required to produce 100 percent mortality of the larvae in the laboratory varied from 3-1/2 hours with 1 gm. of chloropicrin per liter to 22 hours with 0.01 gm., the corresponding periods for pupae being 48 and 72 hours. With 10 gm. per liter all larvae and pupae were killed within 10 minutes. At concentrations toxic to mosquito larvae, chloropicrin also destroyed other insects and aquatic plants, and Gambusia was killed within 4 and 18 hours by concentrations of 0.05 to 0.1 and 0.01 gm. respectively. A cat and dog were not affected by drinking water treated with much higher concentrations for two weeks.

Outdoor experiments were carried out in two pits (3-1/4 by 6-1/2 by 1-1/2 to 4-1/2 ft.) containing water infested with anopheline and culicine larvae and pupae. One hundred grams of chloropicrin was sprayed on the surface of the water in one pit and placed on the bottom of the other in a receptacle. After 15 minutes the mortality was high in the sprayed pit and negligible in the other. On the following day the entire fauna of the former was dead, whereas in the latter a large number of the mosquito larvae and pupae, besides other animals, survived.

PRANDTL, W., GEBELE, H., and FESSLER, J.

(69)

GASKAMPFSTOFFE UND GASVERGIFTUNGEN. WIE SCHÜTZEN WIR UNS? 90 p., illus. Munich. 1932.

The physical properties and physiological action of chloropicrin are described. It is destroyed by spraying with a solution of liver of sulphur and soap solution and is rapidly and fully adsorbed by active charcoal, the latter property being utilized in gas masks (p. 9). A lengthy table is presented, in which chloropicrin is included (p. 84), giving the name, color, odor, action, properties, apparatus for protection, means of neutralizing, first-aid steps, and development and occurrence for a large number of poisonous gases.

RABCEWICZ-ZUBKOWSKI, I.

(70)

FESTLEGUNG DER GÜNSTIGSTEN BEDINGUNGEN FÜR DIE TRENNUNG VON FLÜSSIGEN
BINÄREN GEMISCHEN DURCH DESTILLATION. Roczn. Chem. 12: 161-166. 1932.
[In Polish. Abstract in Chem. Zentbl. 103, II: 2299. 1932.]

The ratio of the vapor pressures, p_1/p_2 ($p_1 > p_2$) was determined
at different temperatures for various liquid mixtures including ether
plus chloropicrin and toluene plus chloropicrin.

REGNIER, P. R.

(71)

LES INVASIONS D'ACRIDIDIENS AU MAROC DE 1927 À 1931. Dir. Gén. Agr. Comm.
Colonis.. [Morocco], Défense des Cultures, No. 3. v + 139 p., illus.
Rabat. 1931. [Abstract in Rev. Appl. Ent. 20 (A): 71-73. 1932.]

Cage experiments with chloropicrin against the locusts Schistocerca
gregaria Forsk. and Locusta migratoria migratorioides Rch. and Frm.
showed that these insects are very resistant to it.

RUMPF, H.

(72)

GASSCHUTZ. 2d ed. 134 p., illus. Berlin. 1932.

Chloropicrin is mentioned as one of the suffocating gases, without
action on the skin, which attack the mucous membrane of the respiratory
organs.

SANFORD, C.

(73)

CHEMISTRY AND WARFARE. Canad. Chem. Metall. 15: 241-244. 1931.

Chloropicrin is mentioned as a war gas which could be produced by
adapting the processes of peace time industry to the needs of chemical
warfare.

SANNA, G.

(74)

PRODUCTION OF CHLOROPICRIN FROM BY-PRODUCTS OF THE ACETONE INDUSTRY.

Rend. Seminario Facolta Sci. Univ. Cagliari 2: 87-89. 1932. Chim.
et Indus. 30: 1387. 1933.

By-products from the distillation of acetone are allowed to fall into
a mixture of concentrated hydrochloric and nitric acids. The reaction is
carried out in the presence of a catalyst (not disclosed), without which
the reaction is too violent, oxidation passes the desired stage and yields
oxalic acid, thus reducing the yield of chloropicrin. This process gives
a 70-percent yield with the tail fractions of either the first or second
rectification of acetone, and a 20-percent yield with mixed acetone oils
or distillation residues.

SCHEPETILNIKOVA, A. M.

(75)

CHLOROPICRIN AS A MEANS OF COMBATING WEEDS AND FLAX SICKNESS IN SOILS.

Chemisation Socialistic Agr. 1933: 128-135. [In Russian. Abstract
in Chem. Abs. 27: 5879. 1933.]

Chloropicrin was found to be a very effective remedy in cases where
the soil becomes "flax sick." It decreases the number of certain fungi
and increases the bacterial flora. Laboratory and field experiments have
shown that chloropicrin is also effective in reducing the weeds. In pots,
the quantities added ranged from 0.013 gm. to 0.28 gm. per kg. of soil.
In the field as much as 20 gm. per sq. m. was used with great success.
The treatment was found to be effective even into the second year.

SKALOV, Y.

(76)

FUMIGATING TOBACCO WITH CHLOROPICRIN. Tabachnaya Prom. (Tobacco Ind.)
1934: 20-22. [In Russian. Abstract in Chem. Abs. 28: 5923-5924.
1934.]

The fumigation was carried out in closed chambers with bales of fermented and unfermented tobacco. A 100-percent mortality of Ephestia elutella Hb. and Lasioderma serricorne F. present in these bales was reached on using 30 gm. of chloropicrin per cu. m. and exposure of 24 hours. The flavor and the color of the tobacco were not affected and the fermentation of the unfermented tobacco proceeded in the usual manner.

SMYTH, C. P., and McALPINE, K. B.

(77)

DIPOLE MOMENTS OF PHOSGENE, HYDROGEN CYANIDE AND CERTAIN SUBSTITUTED METHANES. Jour. Amer. Chem. Soc. 56: 1697-1700. 1934.

The dipole moment of chloropicrin is 1.88.

STONE, M. W., and CAMPBELL, R. E.

(78)

CHLOROPICRIN AS A SOIL INSECTICIDE FOR WIREWORMS. Jour. Econ. Ent. 26: 237-243. 1933.

An emulsion of equal parts of chloropicrin and soap dissolved in water at the rate of about 20 ml. of chloropicrin to 6 gal. of water and applied to soil infested with wireworms (Limonius californicus Mann.) killed 100 percent of the wireworms at a depth of 4 inches and gave a considerable kill down to a depth of 12 inches in both laboratory and field tests. About 25.6 gal. of chloropicrin per acre would be required for field work. Since chloropicrin is quoted at \$0.65 to \$1.00 a pound (1 gal. = 13 lb.), its use in field control would be expensive and not practical except for very valuable crops.

TRAUT, I. I.

(79)

NEW METHODS OF COMBATING THE SIBERIAN MARMOT. Udobrenie i Urozhai (Fertilizers and Yields) 1929: 41-44. [In Russian. Abstract in Chem. Abs. 24: 1940. 1930.]

The use of chloropicrin in place of carbon disulphide in the extermination of the marmots is recommended as the best method.

WAHL, W.

(80)

ÜBER DIE BEZIEHUNGEN ZWISCHEN DER CHEMISCHEN KONSTITUTION UND DER KRISTALLFORM BEI DEN EINFACHERN KOHLENSTOFFVERBINDUNGEN. Ztschr. Phys. Chem. 88: 129-171. 1914.

Chloropicrin crystallizes in the form of long, thin needles which exhibit a strong double refraction and a parallel extinction. It belongs to the tetragonal, hexagonal or orthorhombic system. A further polymorphic modification is not observed above -200°.

WOLTERS, W.

(81)

MEASURES FOR THE CONTROL OF ANOMALIS ORIENTALIS AT THE OAHU SUGAR COMPANY, LTD. Hawaii. Planters' Rec. 38: 264-278. 1934.

Soil fumigants (chloropicrin, carbon disulphide and p-dichlorobenzene) proved to be impractical and uneconomical.

